

**Supplemental Specification
2005 Standard Specification Book**

SECTION 05120

STRUCTURAL STEEL

Delete Section 05120 and replace with the following:

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Materials and procedures for erecting structural metals.

1.2 RELATED SECTIONS

- A. Section 05822: Bearings
- B. Section 09972: Painting for Structural Steel

1.3 REFERENCES

- A. AASHTO M 111: Standard Specification for Zinc (Hot-dip Galvanized) Coatings on Iron and Steel Products
- B. AASHTO M 164: Standard Specification for High-Strength Bolts for Structural Steel Joints
- C. AASHTO M 270: Standard Specification for Carbon and High-Strength Low-Alloy Structural Steel Shapes, Plates, and Bars and Quenched-and-Tempered Alloy Structural Steel Plates for Bridges
- D. AASHTO M 291: Standard Specification for Carbon and Alloy Steel Nuts
- E. AASHTO M 293: Standard Specification for Hardened Steel Washers
- F. AASHTO LRFD Bridge Construction Specifications
- G. AASHTO/AWS D1.5 Bridge Welding Code

- H. ASTM F 606: Standard Specification for Determining the Mechanical Properties of Externally and Internally Threaded Fasteners, Washers, and Rivets
- I. ASTM F 959: Standard Specification for Compressible-Washer-Type Direct Tension Indicators for Use With Structural Fasteners
- J. American Institute of Steel Construction (AISC)
- K. Society for Protective Coatings (SSPC)
- L. UDOT Quality Management Plan
- M. UDOT Steel and Concrete Construction Manual

1.4 SUBMITTALS

- A. Manufacturer's certificate of compliance for nut proof load tests as specified. AASHTO M 291.
 - 1. Certificate must show corresponding lot numbers appearing on the shipping package, certification, test location, time and date, and results of all testing.
 - 2. Include rotational capacity and proof load test results.
- B. Copy of certified mill test reports (MTR) for all fabricated structure materials, seven calendar days before fabrication, including materials manufactured outside the United States. Clearly indicate country of origin on MTR.
- C. Shop Drawings: Submit five copies of shop detail drawings for all fabricated materials.
 - 1. Submit five sets on 11 inch x 17 inch sheets with the Department project designation data, structure number, drawing number, and sheet number in the lower right corner.
 - 2. All details are subject to modification or approval.
 - 3. Do not order materials or begin work until receiving final approval of the shop detail drawings.
 - 4. Do not deviate from the approved shop drawings unless authorized in writing. Contractor is responsible for costs incurred due to faulty detailing or fabrication.
 - 5. Engineer reserves the right to retain these drawings up to 14 calendar days unless they are submitted electronically in which case seven calendar days will apply, without granting an increase in the number of working days for the project. This right applies each time the drawings are submitted.

- D. Erection Plan for Bridges: Submit an Erection Plan 10 days prior to beginning erection of structural steel members for documentation purposes only. The Engineer will not approve the Erection Plan. Fully illustrate the proposed method of erection. Provide complete details of the process including, but not limited to:
1. Temporary supports, bracing, guys, dead-men, lifting devices, connection details and attachments to bridge members.
 2. The schedule and sequence of erection, location of cranes, crane capacities, location of lifting points on the bridge members, member weights, and any other assumed loads.
 3. Complete details for all anticipated phases and conditions during erection.
 4. Minimum number of primary members, secondary members, connections, etc. that must be installed and properly connected to provide structural integrity and stability.
 5. Supporting calculations in accordance with the current edition of the AASHTO LRFD Bridge Design Specifications to demonstrate that factored resistances are not exceeded and that member capacities and final geometry will be correct.
 6. Incorporate into the plan the requirements from this Section article 3.6.
 7. Bolting procedure for field splices and diaphragms on that meets American Institute of Steel Construction (AISC) Manual of Steel Construction requirements.
 8. A professional engineer, licensed in the State of Utah, will approve, sign, and seal the Erection Plan and supporting calculations. The professional engineer must approve any and all changes to the Erection Plan prior to implementation.
 9. UDOT prefers an AISC Advanced Certified Steel Erector (ACSE)

PART 2 PRODUCTS

2.1 STRUCTURAL METALS

- A. As specified unless otherwise indicated. Follow AASHTO LRFD Bridge Construction Specifications, Section 11.3.

2.2 HIGH TENSILE STRENGTH NUTS, BOLTS, AND WASHERS

- A. Use bolts, nuts and washers displaying the manufacturer's markings.
- B. Bolts: As specified in AASHTO M 164 with the following modifications:
1. Maximum tensile strength:
 - a. 150 ksi for bolts 1 inch or less in diameter

- b. 120 ksi for bolts larger than 1 inch in diameter
- C. Nuts:
 - 1. As specified in AASHTO M 291 or AASHTO M 293.
 - 2. Use heat-treated Grades DH and 2H, except use Type DH3 nuts when Type 3 bolts are called for.
- D. Washers: As specified in AASHTO M 293.
- E. Load Indicator Washers: As specified in ASTM F 959.
- F. Certification of Bolts and Nuts (Black and Galvanized): Subject to the Rotational Capacity Test, Section 6.3 AASHTO M 164 and the following requirements.
 - 1. Go through twice the required number of turns (from snug tight condition) in a Skidmore-Wilhelm Calibrator or equivalent tension measuring device without stripping or failure as specified.
 - 2. Maximum recorded tensile strength must be equal to or greater than 1.15 times the required fastener tension as specified.
 - 3. Measured torque necessary to produce the required fastener tension must not exceed the value obtained by the following equation:

	Torque	≤	0.25 PD
Where:	Torque	=	Measured Torque (foot-lbs)
	P	=	Measured Bolt Tension (lbs)
	D	=	nominal diameter (feet)
 - 4. Bolts and nuts require proof load tests as specified in ASTM F 606, Method 1 (Proof Load).
 - 5. Bolts and nuts require wedge tests as specified in AASHTO M 164, Section 6.2.
- G. Foreign Materials:
 - 1. Use foreign manufacturers who have previously established the ability to furnish material uniformly and consistently within the specifications.

2.3 BEARINGS

- A. Refer to Section 05822.

2.4 FABRICATION

- A. Fabricate as specified in AASHTO LRFD Bridge Construction Specifications Section 18, UDOT Steel and Concrete Construction Manual, and Steel Quality Management Plan. AASHTO/AWS D 1.5.
- B. If steel structure is to be part of a bridge structure, the fabricator must have AISC, Major Steel Bridge (CBR) Certification.
 - 1. MSB (CBR) Certification not required for railings, grates, grate frames, and drain pipes. These items may be fabricated with Simple Steel Bridge Structures (SBR) Certification.

2.5 APPROACH SLAB DRAIN ANGLES AND GRATE

- A. AASHTO M 270, Grade 36.
- B. Hot-dip galvanize after fabrication. AASHTO M 111.

PART 3 EXECUTION

3.1 INSPECTION

- A. Notify Engineer immediately upon placing the fabrication order to allow time for shop inspection.
 - 1. Do not begin fabrication until arrangements for shop inspection have been made.
 - 2. Facilitate inspection procedures on site and supply personnel as needed to properly inspect the work.
- B. Allow authorized inspectors free and immediate access to all parts of the plant.
- C. Furnish facilities for inspection of material and workmanship in the mill and shop.
- D. The Inspector has the authority to reject any materials or work not meeting the specifications.
 - 1. Material accepted by the Inspector may be rejected if found defective at a later time.
 - 2. Replace or correct rejected material at no additional cost to the Department.
 - 3. Contractor may appeal disputes with the Inspector to the Engineer for a final decision.

3.2 INSTALLING HIGH STRENGTH BOLTS

- A. Testing:
 - 1. Provide a Skidmore-Wilhelm calibrator or other acceptable bolt tension-indicating device for bolt testing at the job site.
 - 2. Use direct-tension indicators with solid plates when the fastener-grip length is too short to be tested in a Skidmore-Wilhelm calibrator.
 - 3. Check the direct-tension indicators in a Skidmore-Wilhelm calibrator using bolts of sufficient length before using.
- B. Test the installed bolt/nut/washer assembly periodically to verify compliance.
- C. Use direct-tension indicator washers as specified to tighten high strength bolts.
 - 1. ASTM F 959.
 - 2. Tighten bolts according to the manufacturer's methods and procedures or as modified by Engineer.
 - 3. Tighten the fastener to reduce the gap to 0.005 inch or less regardless of which element is turned for tightening.
- D. Install bolts as specified in AASHTO LRFD Bridge Construction Specifications, Section 11.5.6.4 and use the following procedure.
 - 1. Complete the *Bolted Field Splice Certification* form at the end of this section as bolt tightening progresses.
 - 2. Place direct-tension indicator washer where the washers will not be embedded in concrete.
 - 3. Use drift pins to align bolt holes and maintain dimensions and camber of the member.
 - 4. Insert bolts in open holes with washers as specified by the manufacturer, and hand tighten.
 - 5. Tighten at least 50 percent of the bolts (more as required) to approximately $\frac{1}{2}$ final tension to draw all plies of the connection into firm contact. Do not tighten any bolts to indicated full tension at this time.
 - 6. Remove drift pins and replace with bolts.
 - 7. Tighten bolts progressively from fixed or rigid points to the free edges.
 - 8. For field splices and diaphragms fully tighten 50 percent of bolts. Remaining bolts are to be snug tight before release of crane.
 - 9. Tighten all bolts to full tension.
- E. Store the bolts and nuts in the original containers until used.
 - 1. Protect from dirt and moisture.
 - 2. Remove only as many fasteners from protected storage as can be tightened during a work shift, and return unused fasteners to protected storage at the end of each work shift.

3. Clean and re-lubricate fasteners that accumulate rust or dirt resulting from site conditions. Use manufacturer recommended lubricant.

3.3 WELDING

- A. As specified in AASHTO/AWS D1.5, except as modified by the contract.
- B. Field welds must meet the same requirements as shop welds, including inspection by the Department.
- C. When AISC CBR Certification is required for the fabrication of the element, do all field welding under the certification.
- D. Comply with welding procedures and inspection requirements. Refer to UDOT Steel and Concrete Construction Manual.
- E. Welding operators must be pre-qualified. Comply with UDOT Steel and Concrete Construction Manual.

3.4 BEARINGS AND ANCHORAGES

- A. Do not place masonry bearing plates upon bridge seat bearing areas that are improperly finished, deformed, or irregular. Set bearing plates level in exact position with full even bearing.
- B. Locate the anchor bolts in relation to the slotted holes in expansion shoes to correspond with the temperatures at the time of erection. Adjust nut-gap on anchor bolts as shown at the expansion ends to permit free movement of the span.
- C. Form bridge seat bearing areas and place anchor bolts according to details shown.
- D. Place so that identification mark is visible after completion of the bridge.
- E. Do not weld exterior plates of bearings unless at least 1.5 inch of steel exists between the weld and the Elastomer.
 1. Do not subject the Elastomer or the bond to temperatures higher than 400 degrees F.

3.5 SURFACE PREPARATION STEEL

- A. For surface preparation for painting of non weathering steel, refer to Section 09972.

- B. Weathering steel:
 - 1. Construct so that erection marks on the steel are not visible after the structure is completed.
 - 2. Commercially blast all surfaces according to the specification standards. Meet SSPC-SP 6.
 - 3. Commercially blast the following surfaces to meet SSPC-SP 10:
 - a. Underside of the exterior portion of the top flange of fascia girders, and underside of bottom flange of all girders.
 - b. The exterior portion of web of fascia girders.
 - c. Top side and outside edge of the exterior portion of the bottom flange of fascia girders.
 - d. All welded surfaces
 - 4. Develop even patinas at completion of welding repair and after surface has been accepted by engineer.
 - 5. Clean girders of any debris after deck concrete is placed
 - 6. Redevelop patina as needed.

3.6 ERECTION

- A. Maintain responsibility for all aspects of girder erection during all stages of construction, including the protection of structural steel members, the workers, and the traveling public.
- B. Erect structural steel members in compliance with the Erection Plan and in a manner that prevents damage to all elements of the structure.
- C. During erection, temporarily support, anchor and brace primary members such as beams and girders in a manner that will produce the proper alignment and camber in the completed structure.
 - 1. Install cross frames and diagonal bracing as necessary to provide stability and assure correct geometry.
 - 2. Provide temporary bracing or stiffening devices if necessary during any stage of erection.
 - 3. Support, anchor and brace all erected superstructure members as detailed in the Erection Plan before allowing traffic under the bridge.
- D. Design temporary supports and falsework in accordance with the current edition of the AASHTO LRFD Bridge Construction Specifications, Section 3 “Temporary Works.”
- E. Accurately assemble all parts as specified in the contract documents or erection drawings. Follow any match-marks.
- F. Provide any additional materials that are required to keep both the temporary and final stresses within the allowable limits used in design.

- G. Carefully handle materials so that no parts will be bent, broken, or otherwise damaged.
 - 1. Do not injure or distort the members when hammering.
- H. Before the members are assembled, clean bearing surfaces and surfaces that will be in permanent contact.
- I. Do not open traffic under a partially-erected bridge superstructure, unless allowed in the Erection Plan or approved by the professional engineer who approved, signed, and sealed the Erection Plan.

END OF SECTION

Bolted Field Splice Certification follows.

Bolted Field Splice Certification

Consecutively number splices looking stations ahead and increasing from left to right. Copy this page as required. Initial the appropriate box to certify that the bolt tightening has been done in accordance with the specifications.

Do not perform final tightening until the inspector certifies that plates are drawn into full contact. Do not place concrete deck until the inspector has certified that all bolts are properly tightened. Prior to the final inspection, send a completed copy of this form to the State Bridge Engineer, 4501 South 2700 West, Salt Lake City, UT 84119.

Project Number

Structure Number

Splice No.	Top Flange		Web		Bottom Flange	
Plates were drawn into contact with each other before final tightening of any bolts.	Contr. Initials	Inspect. Initials	Contr. Initials	Inspect. Initials	Contr. Initials	Inspect. Initials
Bolts are tightened to spec. (Gap under direct tension indicator is less than or equal to 0.005 inch.)	Contr. Initials	Inspect. Initials	Contr. Initials	Inspect. Initials	Contr. Initials	Inspect. Initials

Splice No.	Top Flange		Web		Bottom Flange	
Plates were drawn into contact with each other before final tightening of any bolts.	Contr. Initials	Inspect. Initials	Contr. Initials	Inspect. Initials	Contr. Initials	Inspect. Initials
Bolts are tightened to spec. (Gap under direct tension indicator is less than or equal to 0.005 inch.)	Contr. Initials	Inspect. Initials	Contr. Initials	Inspect. Initials	Contr. Initials	Inspect. Initials

Splice No.	Top Flange		Web		Bottom Flange	
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